

INTERIM BROOK TROUT MANAGEMENT PLAN  
GREAT SMOKY MOUNTAINS NATIONAL PARK

Problem Statement

The brook trout (*Salvelinus fontinalis*) is the only species of trout native to the Great Smoky Mountains. It was originally present in most streams above 2,000 feet in elevation. Extensive logging operations starting in 1903 led to conditions which eliminated brook trout from about 50 per cent of their original stream mileage. Massive stocking of non-native rainbow trout during the 1930's apparently has prevented the brook trout from reclaiming previously occupied streams. A survey of all streams in Great Smoky Mountains, conducted between 1972 and 1977 by the U.S. Fish and Wildlife Service, indicates that rainbow trout are displacing brook trout.

Brook trout now occupy some 125 miles of streams within the Park, a decrease of 38 miles from the time of the previous survey in 1950, a 70-75 per cent loss of their original range. Brook trout populations are now generally confined to streams above 3,500 feet in elevation. In most cases, a zone of mixed rainbow and brook trout is present immediately downstream from pure brook trout waters, with rainbow trout and brown trout occupying streams at lower elevations.

Vertical waterfalls of eight feet or more apparently create effective obstacles to the upstream movement of rainbow trout. Many of the Park's brook trout populations are isolated above such barriers. In some places rainbow trout are present above waterfalls, probably as a result of stocking. Rainbow trout in the Smokies are larger than brook trout, and may enjoy a competitive advantage in agonistic interactions, foraging, or reproductive success.

The upward movement of the rainbow trout in many places has continued past stream forks, causing brook trout populations to become disjunct. A recent electrophoretic survey by Harris indicates that brook trout populations in the Smokies are becoming genetically fixed, or monomorphic, because of inbreeding within small, isolated populations. Inbreeding of this nature commonly results in recessive alleles becoming predominant, and a decreased ability to adapt to changing environmental conditions.

The replacement of brook trout with non-native species has had unknown effects on other components of aquatic ecosystems. Non-game fish species have not been studied in detail, and the benthic invertebrate fauna remains largely undescribed. Past attempts to stock a New England strain of brook trout in the Park have been unsuccessful.

## Management Efforts

Fishing in pure brook trout streams is prohibited and possession of brook trout is prohibited in the Park. The creel limit on other species is set at four fish, with a nine-inch minimum size limit for most streams, and a 12-inch limit for portions of Little River, Little Pigeon River, Oconaluftee River, and Abrams Creek. Use of bait is not permitted, except in the three designated children's fishing areas, where the creel limit is set at two fish. The Gatlinburg station of the U.S. Fish and Wildlife Service advises the Park on fishing regulations and maintains creel counts and survey data on the distribution of fish species and stream ecology.

The Uplands Field Research Laboratory is conducting research on water quality and aquatic community organization and the influences on trout populations. Other research programs started in the fall of 1977 by Uplands Laboratory will seek to determine abundances, reproduction, growth and production, movements, habitat use, and food habits of brook trout in streams both without and in association with rainbow trout. Distribution and abundance of other fish species, including rainbow trout and brown trout, will be determined and survey of benthic macro-invertebrate communities will be undertaken.

Research by Tennessee Technological University has yielded information on the ecology, behavior, taxonomic status of the brook trout and the effectiveness of removing rainbow trout. The latter research has especially promising management implications. Electrofishing in brook trout restoration waters, when repeated two or more times, can usually result in removal of most rainbow trout present.

## Objectives of the Interim Brook Trout Management Program

- I. Insure the preservation of a viable population of native brook trout.
- II. Maintain only a self-propagating recreational fishery. Future elimination of non-native trout species may be desirable for the sake of ecosystem's integrity, but is not a current goal of Park management.
- III. Better understand the aquatic ecosystems present within the Park and develop management programs designed to maintain all components of these ecosystems in a reasonable approximation of their natural condition.
- IV. Cooperate with state agencies to provide non-native fish removed from Park waters for the enhancement of recreational fishing opportunities outside the Park.

- V. Minimize disturbance associated with restoration and research work, and other management actions.

Methods

To achieve the objectives outlined above, several years of restoration work and research will be required.

Restoration: Starting with about 12 miles of headwater streams, in 1978, rainbow trout will be removed from selected streams using electric shocking equipment. Brook trout and other native species will be left in their original habitat. Rainbow trout will be transferred alive, where possible, to agents of the adjacent states. Where this is not possible, a few rainbow trout will be taken for research, and the remainder translocated to Park waters below natural barriers. Motorized shocking equipment will be used until a dependable and effective battery-powered shocker is developed. Brook trout known to be of the pure Southern Appalachian stock taken from streams in the Smokies will be used for all restocking efforts. Streams with natural barriers will be used for initial restoration efforts; no existing barriers will be modified or artificial barriers constructed until evaluation shows that restoration techniques are effective-- and then only if found environmentally acceptable.

Evaluation: All streams from which rainbow trout are removed will be censused the following year. Results from streams with natural barriers to upward movement of rainbow trout will be compared with results of streams without barriers to measure the effectiveness of restoration techniques. Future work plans will be based on written evaluations prepared by the Resource Management office.

Cooperation: The National Park Service will cooperate with the Tennessee Wildlife Resources Agency and the North Carolina Wildlife Resources Commission in arrangements for transfer of non-native fish removed from streams within the Park. Sportsmen's organizations will be consulted, kept apprised of efforts and results, and their aid enlisted, where possible, to assist in the restoration program.

Research: Understanding the brook trout, and the ecosystems of which it is a part, is critical to sound managerial decision-making. Research currently in progress or proposed for 1978 includes:

- a) Survey of existing brook trout populations to determine numbers and sizes within each population and distribution of fish in regard to water quality, density and types of food organisms and habitat characteristics.

- b) Life history and population dynamics of non-native trout to determine their abundance, age classes, distribution, movements, reproductive activities, growth and food habits. This study will provide management with sufficient evidence to evaluate the possible impact of non-native trout on the aquatic fauna in the Park.
- c) Distribution and abundance of fish species other than trout. This will enable management to determine and respond appropriately to changes in numbers as compared to previous surveys.
- d) Survey of benthic macroinvertebrate fauna to obtain a list of macroinvertebrate species and their distribution, and to assess the structure of macroinvertebrate communities in regard to water quality, habitat, types and predators.

Because of the need for close interaction between research and management, the research, where possible, will be conducted through the Uplands Field Research Laboratory. Research by other qualified persons will be encouraged. They will be assisted with logistic or financial support when appropriate. Other projects will be developed as current research progress dictates.

#### Minimization of Disturbance

All reasonable efforts will be taken to minimize impacts of any management action. Environmental assessments will be prepared for proposed work plans.

#### Long-Term Management Considerations

A long-term approach toward management of the brook trout must emphasize minimization of the effects of exotic species of fish on those streams originally occupied by brook trout. More research is necessary to determine if this objective is biologically and practically feasible.

Evaluation of the restoration program conducted during 1978 will help determine the course of the future management and/or restoration program. Following this, and in conjunction with the U.S. Fish and Wildlife Service and in cooperation with the adjacent State Fish and Wildlife Agencies, the National Park Service will develop the long-range brook trout management plan. When developed, it will become a part of a larger Resource Management Plan now in preparation for the entire Park.